FACIAL VISION: A SUPPLEMENTARY REPORT, WITH CRITICISMS.

Robert MacDougall.

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FACIAL VISION: A SUPPLEMENTARY REPORT, WITH CRITICISMS.

By PROFESSOR ROBERT MACDOUGALL, New York University.

In the fifth volume of *The American Journal of Psychology* Mr. F. B. Dresslar reported an investigation of a phenomenon to which the name "Facial Vision" has been given. This is the capacity to perceive the presence, and with more or less exactness to discriminate the character, of objects in proximity to the blindfolded subject. The faculty is commonly remarked in the blind, and has also been observed among persons possessing sight.

The surmise had been made by Professor James that the perception of such objects might be based upon sensations of pressure on the drum of the ear, due to changes in the movements of the air caused by the presence of the objects in question. Mr. Dresslar's experiments were first directed to this point, and after a series of tests, which seem to have been protected from all invalidating error, the conclusion was reached that the pressure sense of the ear-drum was altogether too obtuse to be considered as a factor in the phenomenon to be explained.

There remained several forms of sensory stimulation to which the presence of objects near the face might give rise, and to the analysis of these attention was next turned. Every large object by which one passes modifies the movements of the air, cutting off the wind on the one side and causing eddies and back-draughts on the other, thereby affecting the sensations of pressure on cheek and brow. It likewise disturbs the local distribution of heat by intercepting the cooling breeze and by absorbing and reflecting the rays of the sun; and by also preventing the free radiation of heat from the body it may give rise to discriminable differences in temperature sensation. Such an object, finally, disturbs the free propagation of sound-waves, intercepting and reducing those coming from the one direction and reinforcing by reflection those which come from the other side.

Any one of these factors severally, or a combination of them, may conceivably afford the sensational basis upon which the reported perception depends. The first two of these aspects are difficult to separate, since the organ of sense in each case is the spread-out surface of the skin. The third element, that of

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sound, may readily be isolated, and it is with its function that the experiments in question are chiefly concerned.

Four frames of wood one foot square were prepared, one of which was filled in solidly, the second latticed with strips three-quarters of an inch in width with intervening spaces half an inch wide, the third covered with wire netting, and the fourth left open. These frames were arranged so that any one could be brought noiselessly to a position three inches from the face of the blindfolded observer, as he sat in a chair. The series of frames was grouped in pairs,—Solid-Wire, Lattice-Open, Solid-Lattice,—so that discrimination was limited to choice between two objects, and was thus both simplified and given definite direction.

With three observers having normal senses experiments with these combinations gave respectively 94, 68 and 90 per cent. of correct responses. Thus the ordinary person seems to have a perception of the proximity of such objects involving a fairly high and reliable discrimination of their detailed features. The observer was then seated with his side to the apparatus, and a screen was interposed between his head and the frames, in the centre of which, and opposite to the passage of the ear, a small hole was pierced. Changes in temperature and pressure sensation due to differences in the filling of the frames were thus practically shut out, yet when the experiments were repeated under these conditions no diminution in the number of correct responses appeared, the percentages being respectively 91, 80 and 93. The figures show an actual increase in discriminative power. Finally the ears were stopped with cotton and the frame presented as in the first set of tests. The preponderance of correct responses, upon which the evidence of a process of perception rests, then entirely disappeared, the percentages being now 53, 51 and 49 respectively. The evident conclusions are that a real process of perception is involved, that it depends upon sensations mediated by the ear, and that these are strictly auditory stimulations of the nature of slight changes in the character and intensity of the confused mass of faint sounds falling upon the ear from moment to moment.

These results show a very high degree of certainty in the responses under conditions where factors of disturbance would naturally be supposed to occasion a large variable error. Correct discrimination rises to above 90 per cent. of the total judgments, even between those objects of the series whose capacities to interrupt radiation and air-currents are most nearly equal. In the discrimination of double contacts upon the skin there appears a region of confused perception, the threshold of which is commonly defined to be that distance which gives rise to 75 per cent. of correct responses. That the material upon

which discrimination proceeds is present in the region immediately below this threshold appears from the preponderance there also of correct responses; but its features are submerged in the mass of subjective and objective variations to which the observer is exposed from moment to moment. By increasing the separation of the points a distance is reached at which the influence of the differential increment becomes clearly greater than that of such disturbing factors; and the valuation of the threshold, —at, say, 75 per cent.,—means simply the agreement upon a proportion between correct and incorrect responses which shall represent a satisfactory margin of preponderance in the constant over the fluctuating differences.

In the experiments now commented upon almost the whole series, exclusive of those with closed ears, gave results which lie above the threshold as thus defined. This is a surprising keenness of perception to be based upon such sensational material. The forms of sensibility upon which discrimination in such cases depends are apparently, in many instances, highly developed in the blind, and no doubt enter as factors into the total complex upon which the reactions of the normal individual are commonly based; but that they are not isolable elements, which can be identified as independent sources of perception, is shown not only by the experience of ordinary life, but also by the fact that under the special conditions of these experiments, in which attention was directed purposely to their analysis, the observers were unable to indicate any single specific sensory change upon which discrimination depended. The personal reports of the observers clearly show their hesitation in assigning the sensations by which the perceptions were mediated, for each enumerates several factors which "perhaps," or "sometimes" were, or "seemed to be" present. In two features all three observers agree, namely, in the impression that temperature changes and a "shut-in" feeling were to be noted, but one only unhesitatingly indicates variations in the auditory content as the basis of perception. But if the ear afforded the means of such exact discrimination as appears in these tables, —nine out of ten responses being correct, roughly speaking,— it is surprising that a clearer identification of the nature of the sensory impression was not made by those who took part in the investigation.

It is, I think, a fair conclusion that judgments based upon auditory material of this kind, too confused and weak to be clearly recognized, should be expected to fall in the subliminal rather than in the supraliminal region. In other words, the proportion of correct responses should be between 50 and 75 per cent., between the indifference point of guessing and the threshold of reliable discrimination.

It may seem an inversion of the natural order of criticism to challenge the high degree of accuracy presented by the reactions of Mr. Dresslar's subjects, since such judgments do, of course, shift from guesswork to unvarying correctness according as the values of the constant and variable factors vary. Nevertheless though such a percentage might well reflect perception based upon a group of co-operating sense data of different orders, no one element of which could be readily isolated, it seems too high to be justifiable on the sole basis of such an auditory factor as is described in the report. It is the interpretation of the sensory sources, not the proportion of correct responses, to which my criticism is directed. Notwithstanding the apparent conclusiveness of the final test, *i. e.*, with the stopped ears, I am convinced that throughout Mr. Dresslar's experiments other than auditory factors were significant, and that the method of excluding the latter involved concomitant changes which interfered with the process of perception at large. The curious distribution of sensory types in the two investigations is sufficient to arouse suspicion of this kind, for it is improbable that in the one should be fortuitously gathered three observers of exclusively auditory type, while the reports of all those in the other indicate the presence of additional sensory values, though not to the elimination of the sound factor itself.

In view of several considerations the present writer made a substantial repetition of Mr. Dresslar's experiments, the only difference to be noted being the substitution of the combination Solid-Open for that of Solid-Wire, which gives a slightly wider range of objective differences than were incorporated in the original investigation. Apparatus and signals were controlled from a distance (yet within the same room), and responses were given by pressure upon an electric key. Three persons took part in the investigation, all of whom had had previous training in laboratory research. Thirty judgments of the several combinations were made under each experimental variation, the members of the pairs being presented an equal number of times in every series of tests. The total number of judgments thus lay between two and three thousand.

The results confirm Mr. Dresslar's conclusions that the person of normal sensory condition and without special training is sufficiently affected by such stimulus variations as are here in question to be able, independently of the sense of sight, to detect the proximity of the various frames, and in some degree to discriminate their individual differences. The observers who took part in the investigation were of various grades of sensibility, their correct responses under all conditions bearing the following mutual ratios: A, 1.00; B, 0.91; C, 0.85.

In the case of even the most obtuse observer, however, a clear margin of positive discrimination appears, so that there is no reason to doubt the presence of a true perceptual process, based on (at least) subliminal differences in sensation.

The distracting influences noticed in the course of the work were of two types, tactual and auditory. In the early part of the investigation visual perception was eliminated by lightly bandaging the observer's eyes. The presence of this girdle being complained of, the blinds of the dark-room in which the experiments were carried on were closely drawn and the bandage removed, the observer also closing his eyes during the course of the test. The result of this change was to increase the number of correct responses from 62.3 to 71.0 per cent., all observers and experimental conditions included. Further, at the beginning of the investigation, which was carried on during the months of May and June, the windows of the room were kept partly open, in consequence of which the sounds arising from breathing movements, etc., were augmented many fold by the noises of the street near by. This also was found a serious distraction, to remedy which, first, the window was closed, and secondly, the tests were later made at midnight when streets and building were deserted. The proportion of correct responses underwent corresponding changes, as follows: Day, window open, 58.3%. Day, window closed, 62.3%. Midnight, 71.0%. Concerning these concomitant variations, which in themselves afford further evidence of the presence of a perceptual process, it is to be observed that there are two separate bearings which such changes in the physical surroundings may have upon the latter process. One is the distracting influence already spoken of, which the presence of the auditory or tactual stimuli exerts upon the attention; the other consists in possible modifications of the stimulation or of the sense organ upon which the perceptual process depends. In addition to its distracting influence the bandage about the temples interferes with the normal radiation of heat from the skin and reduces the sensitive surface exposed to stimulation by changes in the temperature or movements in the air immediately surrounding the body. The street noises, likewise, both disturb attention and modify the character and violence of the stimulation falling upon the ear. But it is also to be remarked, in considering the points of difference between this and the preceding investigation, that while in the case of the bandage the two sets of influences clearly work together, that which increases the sensory area at the same time reducing the distraction, in the case of auditory disturbances there is no such evident correlation. On the contrary, a result of the opposite character is to be expected, since the absolute differences

in stimulation caused by the introduction of an object which more or less shields the ear from impinging sound-waves must be greatest when the volume of stimulation is itself at a maximum. Since, therefore, the changes are of the same sign in both cases, and the greater increase takes place in connection with the reduction of auditory disturbances, the influence which these factors exert is to be attributed to mental distraction and not to their immediate sensory values.

The proportion of correct responses obtained from the present set of observers differs largely from those reported in the original investigation. The individual averages for all conditions tested are severally as follows: A, 54.7; B, 58.3; C, 64.0 per cent. Individual extremes for single sets of conditions range from 54.3 to 73.0 per cent. of correct responses. These proportions lie wholly within the limits which, on the whole, as was pointed out in the earlier part of this paper, are to be expected from the nature of the conditions under which perception works.

A second point to which attention may be called in connection with this investigation is the relation of the proportion of correct responses to the magnitude of the differences existing between the objects to be discriminated. The applicability of the method of right and wrong cases depends upon the fact that if the phenomenon involves a true process of perception the percentage of correct responses under any given set of conditions should be a correlate of the series of differential increments presented by the sensational material upon which it is based. The absence of such a concomitant variation indicates either guesswork or a source of knowledge independent of the sensory process.

The series of objective differences in the materials employed in the present investigation are, in order of increasing magnitude, as follows: Lattice-Open, Solid-Lattice, Solid-Open. The corresponding proportions of correct responses are, in the same order: 59.0; 62.0; 65.2 per cent. The number of correct responses varies concomitantly with the magnitude of the sensational differences to be discriminated, as it must necessarily do in any extended series in which a true perceptional process is involved. That this general average does not result from the fusion of inconsistent types of change may be seen from a comparison of the individual averages upon which it is based. These are for the three observers respectively: A., 52.3%; 56.7%; 62.3%; B., 59.9%; 59.7%; 62.3%; C., 63.0%; 67.0%; 70.3%. Thus throughout practically the whole set of judgments the proportion of correct responses reflects the series of differences presented by the objects to be discriminated, affording conclusive evidence that a true perceptual process is

involved in the phenomena. It is to be noted that though the percentage of correct responses made when a partial interruption of any sensory stimulus occurs must lie between the extremes presented by complete interference on the one hand and the absence of any reducing agent, yet in the case of sound at least there is not a quantitative proportion between the amount of physical interference and the intensity of the resulting sensation. To cover one half of the aperture, for example, does not reduce the loudness of the sound by the same amount. Re-arranging his differences in view of this fact Mr. Dresslar's results also present the above evidence of a true factor of perception.

No such essential dependence upon auditory processes as appears in Mr. Dresslar's results were found in the experiments here reported. The only departure from the conditions of the original investigation consisted in the substitution of conical plugs of soft rubber for those of cotton wool, on account of their greater impermeability to sound. The average for all observers under the three experimental conditions are as follows: Frontal, ears open, 65.7%; Frontal, ears closed, 62.3%; lateral, facial sensibility excluded, 56.7%. The highest proportion of correct responses occurs when all the normal avenues of sense are open; the lowest, unlike the results previously reported, appears when stimulation of hearing alone is permitted. The latter discrepancy, however, is of secondary importance, since it can be speculatively resolved into factors of imperfect control, etc.

The feature which cannot thus be reconciled is the fact that the plugging of the ears was followed by a decrease of only 2.4 per cent. in the correct responses made. In other words, for this particular set of observers the shutting off of auditory stimulation left the capacity to make such discriminations practically untouched. It is to be remembered in this connection that the mode of excluding auditory impressions inevitably introduced a serious factor of disturbance in the novel and unpleasant sensations due to the presence of the plug in the meatus of the ear, a factor which alone is sufficient to account for the falling off which appears in discrimination under these conditions. It seems necessary, therefore, to revise the conclusions of the previous report by recognizing that their application must be limited to such persons as conform to the special type of sensibility presented by those who took part in that investigation.

The small number of correct responses which were made in the present investigation when facial sensibility was excluded and auditory stimulation alone relied on, does not necessarily indicate that the ear plays no part,—or even, in individual

cases, a small part,—in the process of discrimination. The arrangements for this test were such that slight uncontrollable variations in the experimental conditions might conceivably interfere to a serious extent with the changes in stimulation caused by the different objects, and thus reduce the proportion of correct responses. All observers did not present the same curve in this regard; in two, discrimination was at its minimum during auditory stimulation, while in the third it was at its maximum, as follows (results being given in the order: frontal, ears open; frontal, ears closed; lateral, facial sensibility excluded): A., 56.7%; 54.3%; 58.3%; B., 62.4%; 63.0%; 56.7%; C., 73.0%; 68.6%; 55.0%. Further, Observer B., one of the former group, made the highest percentage attained in the course of the investigation during a supplementary experiment in which a large megaphone of stiff paper rolled into a cone was arranged with its apex inserted in the ear passage and its mouth brought within a couple of inches of the suspended frames. Under these conditions 80.0 per cent. of the responses were correct in a total of ninety judgments.

It thus appears that the process in question is not restricted to any one type of sensory stimulation, but may depend in different individuals, upon any one of several such sources, and in ordinary cases probably involves a combination of these. That to which, in addition to hearing, I should call attention, as likely to play an important part in the process, is the sense of temperature. The interference with the normal radiation of heat caused by solid objects in proximity to the skin results in changes of temperature at its surface that are by no means small, and I am inclined to believe that if a delicate thermometer were employed to test their fluctuations the latter would be found to parallel the variations in the proportion of correct and incorrect responses according as the object was made to approach or recede from the skin.

NOTE. Since submitting this manuscript I have been informed by the Director of the psychological laboratory at Clark University that through an imperfection in the report a misinterpretation has arisen in regard to two points of the original investigation. These are that the interspaces were of equal width with the strips in the lattice, and that no experiments were made with the screen in front of the face, it being at the side of the head in all three series.

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